REMARKS

Entry of the foregoing amendments and reconsideration and allowance of the present application are respectfully requested.

In paragraphs 1 and 2 of the Office Action, the Examiner rejected Claim 8 under the provision 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

It is respectfully submitted that dependent Claim 8, as currently amended, is definite and particular points out and distinctly claims the subject matter which applicants regard as their invention. Support of the amendment can be found in the originally filed specification on page 5, lines 19-24. For these reasons, it is requested that the rejection of Claim 8 under the provision 35 U.S.C. 112, paragraph second be withdrawn.

Likewise, new dependent Claim 13 has been added and is fully supported in the specification (see page 5, lines 19-24). No new matter has been added.

In paragraphs 3 and 4 of the Office Action, the Examiner rejected Claims 1, 3, 5 8-10 under the provisions of 35 U.S.C. 102 (b) as being anticipated by U.S. Patent No. 2,323,498 to Thompson. Reconsideration is respectfully requested.

A prima facie case of anticipation, according to the Federal Circuit, "requires the presence in a single prior art disclosure of each and every element of the claimed invention." *Lewmar Marine v. Barient, Inc.* 3 USPQ2d 1766, 1767 (Fed. Cir. 1987). Because the Thompson '498 reference does not meet that standard, applicants respectfully request withdrawal of the Section 102 rejection

The present invention, as amended herein, is directed to a furnace for cracking hydrocarbon feed to produce olefins, having at least one fired radiant chamber that is divided into at least two separate independent radiant zones by a dividing means. The furnace comprises multiple radiant chambers that have separate independent radiant zones, ***each with independent process coils***, and each separate independent radiant zones temperature can be controlled independently. Moreover, because of the use of different and independent process coils for each radiant zone in the same furnace, the furnace of the present claimed invention is capable of cracking more than one feedstock under different reaction conditions at the same time to produce entirely different product slates.

The Applicant acknowledges that Thompson '498 describes a combination radiation and convection furnace for heating streams of fluids, either in liquid, vaporous or gaseous state and mixed phases. However, the use of separate combustion zones with **one continuously connected (not independent)** vertical and horizontal fluid conduit capable of reverse flow in the cited prior art does not teach or suggest the present claimed invention. More particularly, Thompson '498 does not provide for an effective and efficient method for cracking more than one feedstock at a time. Instead, Thompson '498 describes a simple furnace capable of heating only one fluid in a radiation and/or convection zone.

Moreover, Thompson '498 discloses a furnace whereby "[I]n the fluid heating zone 8, a plurality of substantially U shaped fluid conduits . . . communicate , respectively , with a plurality of substantially vertical, parallel conduits in the respective radiant heating zones" (see Thompson at col. 2, lines 45-50). In Thompson '498, a single feed line to the inlet manifold 11 in the convection area of the furnace is connected to

vertical fluid conduits within the radiant heating zones and "communicates with each of **the individual fluid conduits", (see Thompson at col. 2, lines 50-54)** within the furnace (see also Thompson, Claims 4-6). Thus, in Thompson '498, in particular, only **one feedstream** is disclosed as being fed to the reactor and all conduits within the reactor use this one feedstream. In this regard, the heater disclosed in Thompson '498 is reduced in flexibility in comparison to the present claimed invention because it is capable of heating only one liquid or gas at a time.

Further, in Fig. 4, Thompson '498 again teaches only one inlet manifold 20 within the radiant heating zone (see Thompson at col. 3, lines 49-54), wherein only one fluid can be introduced into the furnace. Moreover, Thompson teaches a furnace to heat **one** fluid or gas at a time. In particular, Thompson teaches the introduction of one fluid or gas into a singular manifold which is then divided into a plurality of small streams that flow through the side wall tubes (see Thompson at col. 3, lines 49-55). However, there is no disclosure to use separate process coils or feed lines for various liquids or gases at various conditions within each of the fired radiant chambers of the furnace.

The Thompson '498 reference clearly does not teach a furnace having a fired radiant chamber separated into at least two separate independent radiant zones capable of handling more than one feedstock and/or to crack at different conditions to provide different product slate as claimed in the present invention by provision of a separate independent process coil for each independent radiant zone. For these reasons the § 102(b) rejection over Thompson '498 is improper and withdrawal of the rejection is therefore respectfully requested.

In paragraphs 5-8 of the Office Action, the Examiner rejected Claims 2 and 4 under 35 U.S.C. 103(a) as being unpatentably obvious over U.S. Patent No. 2,323,498 to Thompson. Reconsideration is respectfully requested.

As noted by the Examiner, Thompson '498 does not disclose the use of more than one radiant chamber. Further, as more fully set forth above, Thompson '498 does not disclose or suggest in any way a radiant chamber divided into at least two separate independent radiant zones wherein each zone is provided with its own independent process coil. Moreover, there is absolutely nothing in the Thompson reference to suggest a modification to create a furnace with independent zones having separate process coils for handling more than one feedstock capable of cracking at different conditions to provide different product slates.

As indicated on page 2 of the originally filed specification, the current trend in the industry is for the building of larger plants with increased capacity. As a requirement of these plants, the industry is also requiring a lesser number of reactors, which in turn, severely hampers the flexibility of these plants. Thus, a need has arisen in the art to provide a furnace that meets the needs of the industry for larger and lesser furnaces, but that can also provide the flexibility to crack different feedstocks, at different reaction conditions. The present claimed invention unexpectedly meets the needs of the industry by providing a large furnace having separate independent radiant cracking zones, each equipped with its own independent process coil and temperature control means.

The Thompson '498 patent does not teach or suggest, and cannot be construed to teach or suggest such a novel and unobvious furnace design. The furnace of Thompson '498 is taught only to have a single process coil that can be cracked in different portions

of a radiant furnace. There is no suggestion that in Thompson '498 to provide a single furnace that is fed with independent process coils, such that each zone of the furnace can be cracked with the same or different feedstock. Accordingly, it is respectfully submitted that the present claimed invention is unobvious over the Thompson '498 reference.

In paragraph 9 of the Office Action, the Examiner rejected Claims 6-7, 11-12 under 35 U.S.C. 103(a) as being unpatentable over Thompson U.S. Patent No. 2,323,498 in view of Kushch et al., U.S. Patent Nos. 6,159,001 or 5,711,661. Reconsideration is respectfully requested.

The Examiner noted that the cited prior art fails to disclose the specific material of the dividing means as presently claimed. Upon comparison to the present invention, it must be pointed out that the deficiencies of Thompson, as more fully addressed above, are not cured by combination with the cited secondary references. More particularly, there is no suggestion to combine the references to come up with the present claimed invention. In this regard, although Kushch et al. discloses an emissive matrix made of a ceramic fiber, "optically thin" to allow photon energy to be captured by radiant heat exchangers (see col.3, lines 30-39 and col. 4 line 54), the teachings of the secondary references do not cure the deficiencies of Thompson. Such a combination would merely result in a furnace with a dividing means of ceramic fiber with no independent process coils and feedstock for multiple cracking slates.

In contrast to the cited references, the claimed present invention is a furnace for cracking hydrocarbon feed to produce olefins, having at least one fired radiant chamber that is divided into at least two separate independent radiant zones by a dividing means.

The furnace comprises multiple radiant chambers that have separate independent radiant zones with separate process coils that can be controlled independently for improved flexibility. Therefore, the furnace of the present claimed invention is capable of cracking more than one feedstock under different reaction conditions at the same time.

It is maintained that the prior art references do not teach or suggest the present invention and the present claims are not unpatentable under § 103(a) over the references of record.

In view of the foregoing discussion, applicant respectfully submits that the pending claims are allowable over the cited prior art. Allowance of the claims is therefore respectfully solicited.

Respectfully submitted,

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37 C.F.R. 1.121(c)(1)(ii) ATTACHMENT

1. (Amended) A furnace for cracking hydrocarbon feed to produce olefins, said furnace comprising:

(a) at least one fired radiant chamber, wherein said radiant chamber is divided into at least two separate independent radiant zones by a fired radiant chamber dividing means;

(b) at least one radiant burner in each said zone of said fired radiant chamber;

(c) a convection chamber in direct communication with said fired radiant chamber;

(d) at least one independent process coil for each said separate independent radiant zone, wherein each said independent process coil extends through at least a portion of said convection chamber and extends into one of said separate independent radiant zones before exiting said furnace;

(e) a flue for discharging flue gas located at the top of said convection chamber of said furnace;

(f) a means for independently controlling the radiant burners in each said separate independent radiant zone.

2. (Twice amended) A furnace for cracking hydrocarbon feed to produce olefins, said furnace comprising:

(a) at least two fired radiant [chamber] chambers, wherein said radiant chamber is divided into at least two separate independent radiant zones by a fired radiant chamber dividing means;

(b) at least one radiant burner in each said zone of said fired radiant chamber;

(c) a convection chamber in direct communication with each said fired radiant chamber;

(d) at least one independent process coil for each said separate independent radiant zone, wherein each said independent process coil extends through at least a portion of said convection chamber and extends into one of said separate and independent radiant zones before exiting said furnace;

(e) a flue for discharging flue gas located at the top of each said convection chamber of said furnace; and

(f) a means for independently controlling the radiant burners in each said separate independent radiant zone.

8. (Twice Amended) A furnace as defined in Claim 1 wherein said means for independently controlling the radiant burners in each said separate independent radiant zone comprises a [means for controlling the temperature of each said separate independent radiant zone independently] fuel regulator.